a non-linear medium for each of said plurality of intra-cavity phase conjugators wherein said non-linear medium is adapted to produce at least two coherent pump beams; and

a means to encode said coherent pump beams.

47. (New) The system of claim 46, wherein said nonlinear medium is a diode structure comprising a broad-area distributed feedback laser device.

48. (New) The system of claim 18, wherein said intra-cavity phase conjugator with said top electrode includes:

a nonlinear medium adapted to produce at least two coherent pump beams; and

a means to encode said coherent pump beams.

49. (New) The system of claim 48, wherein said nonlinear medium is a diode structure comprising a modified broad-area distributed feedback laser device.

REMARKS

The foregoing amendments are responsive to the Office Action mailed on August 24, 2001. Claims 1-44 are pending in this application. By the foregoing amendments, new claims 45-49 have been added. Support for the new claims can be found, inter alia, in Applicants' specification and original claims. Thus, claims 1-49 are presented for examination.

Accompanying this communication is a petition to extend the prosecution on this matter for three months and the appropriate fee. Also attached to this response is a

version showing the changes made titled "Version With Markings To Show Changes Made." Reconsideration and allowance of claims 1 -44 and allowance of new claims 45-49 is respectfully requested.

Brief Discussion of the Invention

The present invention comprises a system and method of remotely extracting information from a communications station by interrogation with a low power beam. Nonlinear phase conjugation of the low power beam results in a high power encoded return beam that automatically tracks the input beam and is corrected for atmospheric distortion. Intracavity nondegenerate four wave mixing is used in a broad area semiconductor laser in the communications station to produce the return beam.

Discussion of the Office Action

In the Office Action of August 24, 2001 the Examiner objected to claims 38 and 39 for informalities in the wording of the claims. She rejected claims 3, 10, 11, 34 under 35 U.S.C. §112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. She rejected claims 24, 26, 29-30, and 42-44 under 35 U.S.C. §102(b) as being anticipated by Pepper et al. (US Patent No. 5,038,359 A). She rejected claims 34 and 35 under 35 U.S.C. §102(b) as being anticipated by Akkapeddi (US Patent No. 4,949,056 A). She rejected claim 34 under 35 U.S.C. §102(b) as being anticipated by Sharp et al. (US Patent No. 5,317,442 A). She rejected claims 1-12, 14-17, and 41under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi in view of Pepper et al. She rejected claims 18-21 under

35 U.S.C. §103(a) as being unpatentable over Akkapeddi in view of Pepper (US Patent No. 4,767,195 A). She rejected claims 13 and 40 under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi in view of Pepper et al. and Pepper. She rejected claim 22 under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi et al. or Sharp et al. She rejected claim 23 under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi or Sharp et al. as applied to claim 22, and further in view of Pepper et al. She rejected claims 25, 28, and 31-32 under 35 U.S.C. §103(a) as being unpatentable over Pepper et al. She rejected claims 27 and 33 under 35 U.S.C. §103(a) as being unpatentable over Pepper et al. in view of Pepper. In addition, she rejected 35-39 under 35 U.S.C. §103(a) as being unpatentable over Sharp et al. in view of Pepper et al.

Discussion of Objection of Claims 38-39

As set forth above, claims 38 and 39 have been objected to because the phrase "at least on pump beam" in line 2 of both claims 38 and 39 have been amended to "at least one pump beam." In light of the amendments to claims 39 and 39, such an issue is believed moot.

Discussion of Claims 3, 10, 11, and 34 under 35 U.S.C. § 112

As set forth above, claim 3, 10, 11, and 34 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In light of the amendments to claims 3, 10, 11, and 34, such an issue is believed moot.

Rejection of Claims 24, 26, 29-30, 34-35 and 42-44 under 35 U.S.C. §102(b)

As set forth above, claims 24, 26, 29-30 and 42-44 were rejected under 35 U.S.C. §102(b) as being anticipated by Pepper et. al. (U.S. Patent No. 5,038,359 A). Applicants respectfully traverse these rejections. The Examiner references Figure 1 in Pepper et. al. with respect to claims 24 and 42 respectively. Hereinafter are arguments against the Pepper et al. patent to support the assertion that Pepper et al. does not anticipate claims 24, 42, and dependent claims thereof as stated by the Examiner.

Regarding **claim 24**, the Examiner states that "Pepper et al. disclose an optical interconnection system (Figure 1) comprising: a fiber optic device (Column 5, lines 17-25) constructed to transmit an interrogating beam (with laser 20); and a micro-mirror 16 adapted to receive the interrogating beam and transmit the beam to a pre-determined phase conjugator (medium 12)." Regarding **claim 42**, the Examiner states that "Pepper et. al disclose a method of providing an optical interconnect comprising: transmitting an interrogating beam from a fiber optic device; receiving the interrogating beam at a micro-mirror 16 across free space; transmitting a second beam from micro-mirror to a predetermined phase conjugator 12."

Applicant respectfully submits that nowhere in Pepper et. al. is it disclosed or suggested that the phase conjugator used in Pepper is a nondegenerative four wave mixing conjugator in an "intra-cavity" semi-conductor package as used by the Applicant. For example, Pepper et al. (Figure 1, Column 5, lines 29-30), describes a phase conjugate apparatus that "includes a non-linear medium 12 capable of two wave mixing by SPS." SPS was defined in Pepper (Column 1, line 36) as "stimulated photorefractive scattering." Pepper et al. does teach a four-wave mixer (Column 10, lines 23-46, and Fig. 8) but the non-linear photorefractive medium is part of the embodiment. The Applicant, conversely, describes in his application (Figure 4, page 10, lines 5-7), "Figure 4 is an elevational view of the non-degenerative four wave mixing (NDFWM) in broad area (multimode) semiconductor laser diodes 334 (rather than passive photorefractive crystals)....." Thus, Pepper et. al. requires a non-linear medium (i.e., a crystal) as part of a phase conjugation system, which incorporates the photorefractive effect, whereas Applicant utilizes a self-contained, "intra-cavity" phase conjugation system in a semiconductor package.

In addition, Applicants respectfully submit that nowhere in Pepper et. al. is it disclosed or suggested that the retroreflector array **16** in Pepper et. al. is Applicants' claimed micro-mirror adapted to receive and or transmit an interrogating beam across free space to a phase conjugator. In (Column 5, lines 33-36), Pepper et. al. states: "In accordance with an important feature of the present invention, a retroreflector array **16**, which acts as a pseudo-conjugator, is dispose (sic) behind the medium **12**." The Applicants in (claim 24, element 2) claim "a micro-mirror adapted to receive the

interrogating beam and transmit the beam to a predetermined phase conjugator." In (pre-amended claim 42, elements 2-3), Applicants claim "receiving said interrogating beam at a micro-mirror across free space; transmitting a second beam from micro-mirror to a predetermined phase conjugator. Thus, Applicant respectfully submits that the retroreflector array 16 referenced by the Examiner in Pepper et. al. is part of Pepper's phase conjugator apparatus, (i.e., "a pseudo-conjugator"), as opposed to Applicants' micro-mirror which is a device designed to receive the interrogating beam and transmit the beam to an **intra-cavity**, semi-conductor phase conjugator.

Thus, this ground of rejection of claims 24, 42 and dependent claims thereof under 35 U.S.C. §102(b) is improper and should be withdrawn.

As set forth above, **claims 34** and **35** were rejected under 35 U.S.C. §102(b) as being anticipated by Akkapeddi (U.S. Patent No. 4,949,056 A). Applicant respectfully traverses this rejection. The Examiner references Figure 1 in Akkapeddi with respect to claims 34 and 35 respectively. The Examiner additionally references (Column 2, lines 15-60) in Akkappedi in rejecting claims 34 and 35 and states that Akkappedi disclose a system and a method that anticipates Applicant's invention. Hereinafter are arguments against the Akkapeddi patent to support the assertion that Akkapeddi does not anticipate claims 34 and 35 as stated by the Examiner.

Applicant's claims 34 and 35 should not be rejected on the basis of Akkapeddi (U.S. Patent No. 4,949,056 A) because Akkapeddi does not teach every aspect of the Applicant's invention. In (Column 2, lines 23-26), Akkapeddi states "The laser beacon transmits a Stokes-shifted Raman wavelength (λ_R) which exactly matches the

vibrational or electronic states of a ground based Raman amplifier 12." In addition, the phase conjugator in Figure 2 in Akkapeddi is described (Column 2, lines 36-39), as "a non-linear crystal 18, such as ruby." Applicant, conversely, teaches as stated above for the similar arguments against Pepper et al, an intra-cavity phase conjugation system in a semiconductor laser diode structure. Applicant further discloses (See specification, page 6, lines 13-15) a broad area laser micro-phase conjugator, which amplifies and encodes an interrogating laser beam and returns it precisely to the beam source. Thus, the Applicant does not use Raman techniques for interrogation and amplification, nor do they use any type of crystal as a means for phase conjugation. In addition, Akkappedi disclose a phase conjugation system that utilizes a pump laser. For example, Akkappedi (Figure 2, and Column 2, lines 34-39) states: "Fig. 2 illustrates a phase conjugator 16 employing four wave mixing....It comprises a non-linear crystal 18, such as Ruby....Crystal 18 is irradiated by a tunable laser." Applicants conversely, teach a semiconductor device that is operated as the entire phase conjugator (i.e., an intra-cavity semiconductor phase conjugator).

Accordingly, under MPEP 706.02(a), it is well established that for a reference to support a rejection under 35 USC §102, that reference must teach every aspect of the claimed invention. Thus, this ground of rejection of claims 34 and 35 under 35 U.S.C. §102(b) is improper and should be withdrawn.

As set forth above, **claim 34** was rejected under 35 U.S.C. §102(b) as being anticipated by Sharp et al. (U.S. Patent No. 5,317,442 A). The Examiner references Figures 2 and 5 in Sharp et. al in rejecting claim 34.

Applicant's claim 34 should not be rejected on the basis of Sharp et. al because Sharp et. al does not teach the Applicant' s invention. Sharp et. al states in (Column 3, lines 10-17), "The present invention takes advantage of the ability of certain photorefractive media....Photorefractive material 10 acts as a phase conjugator....Material 10 is a photorefractive crystal such as barium titanate ($BaTiO_3$) or tungsten bronze structure crystals." Applicant, conversely, as stated above in the similar arguments against Pepper et. al, does not use the photorefractive effect (See applicant's specification, Figure 4, page 10, lines 5-7), but instead incorporates "intra-cavity" broad area (multimode) semiconductor laser diodes rather than passive photorefractive crystals.

Accordingly, this ground of rejection of claim 34 under 35 U.S.C. §102(b) is improper and should be withdrawn.

Discussion of Rejection of Claims 1-12, 13, 14-17, 18-21, 22, 23, 25, 27, 28, 31-32, 33, 35-39, 40, and 41 under 35 U.S.C. §103(a)

Claims 1-12, 14-17, and **41** stand rejected under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi in view of Pepper et al. Applicant respectfully traverses the rejection of claims 1 and 41 and dependent claims thereof which contains the limitations of claim 1.

Applicant's claim 1 is as follows:

1. A system comprising:

   a transceiver constructed to transmit an interrogating beam;

   a communication station capable of receiving said interrogating beam; and

said communication station having a plurality of phase conjugators arranged in an array.

Regarding **claim 1**, the examiner indicates that Akkapeddi (Figure 1) disclose a system comprising: a transceiver 10 constructed to transmit an interrogating beam; and a communication station capable of receiving the interrogating beam. The examiner further indicates that Akkapeddi includes a phase conjugator but does not specifically disclose that the communication station includes a plurality of phase conjugators arranged in an array. The Examiner then adds that Pepper et al. (Figures 9-10; column 10, lines 47-68; column 11, lines 1-17) teach that a plurality of phase conjugators arranged in an array may be used in a system to produce a phase conjugate system as disclosed by Akkapeddi to provide a broader area to produce phase conjugation.

The primary reference teaches a phase conjugator as part of the reference's system but the phase conjugator in Akkapedi (as discussed above in the arguments for the 35 U.S.C. §102(b) rejection of claims 34 and 35), is a ground based Raman amplifier wherein its vibrational and electronic states is matched by a Stokes-shifted Raman wavelength (λ_R) beacon. Conversely, the Applicant's phase conjugator is a micro semi-conductor **intra-cavity** device that operates as a phase conjugator **without** the need for an external pump laser source and Applicant's phase conjugator **does not** need a non-linear crystal for obtaining phase conjugation.

There must be a basis in the art for combining or modifying the references to arrive at Applicant's claimed invention. Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some

teaching, suggestion or incentive supporting the combination. ACS Hospital Systems, Inc. v. Montefiore Hospital, 221 USPQ 929, 933 (Fed. Cir. 1984) and In re Geiger, 2 USPQ2d at 1278 (Fed. Cir. 1987). Thus, Applicant submits that there is nothing in any of the cited references to teach, suggest or provide incentive in support of the combination of elements recited in applicant's claim. In addition to the differences stated above in the primary reference, Pepper et al. teaches a plurality of phase conjugators arranged in an array that uses a non-linear crystal and Stimulated Photorefractive Scattering as part of its phase conjugation scheme. Applicant, conversely, discloses a system incorporating **intra-cavity** micro phase conjugators arranged in an array wherein the preferred embodiment (see Applicant's specification, page 13, lines 13-15) typically incorporates a 100-micron diameter aperture by 300 micron by approximately 2000-micron device structure. Thus, the Applicant's invention **does not** use a non-linear crystal as part of his phase conjugation system and the Applicant **does not** use Stimulated Photorefractive Scattering as a means to phase conjugate.

Accordingly, the primary and secondary references teach different technologies and provide no suggestion or incentive to combine elements in order to support an obviousness rejection. Thus, this ground of rejection for claim 1 and dependent claims thereof under 35 U.S.C. §103(a) is deemed to be improper and should be withdrawn.

Claims 18-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi in view of Pepper (U.S. Patent No. 4,767,195). Applicant respectfully traverses the rejection of claim 18 and dependent claims thereof which contains the limitations of claim 18. The Examiner again refers to Figures 1 and 2 in Akkappedi and

regarding claim 18 states: Akkapeddi discloses a system comprising: a transceiver constructed to transmit an interrogating beam; a communication station capable of receiving the interrogating beam; and the communication station having a phase conjugator. The Examiner adds that although Akkappedi does not specifically disclose that the phase conjugator includes a top electrode, the reference does disclose an aperture located in the top of the phase conjugator. The Examiner adds that Pepper teaches the phase conjugator including a top electrode and that it would have been obvious to a person of ordinary skill in the art to use a phase conjugator as taught by Pepper in the system disclosed by Akkapeddi.

Applicant submits that that the Examiner has not supported her contention that it would have been obvious to a person of ordinary skill in the art to use a phase conjugator as taught by Pepper in the system disclosed by Akkapeddi to arrive at Applicant's invention. As stated in the above arguments for the 35 U.S.C. §102(b) rejection of claims 34 and 35, the Applicant does not use a phase conjugator with a non-linear crystal and an external laser pump source for the phase conjugator as taught by the primary reference. In addition, the secondary reference uses an electrode to establish an electric field in a non-linear crystal to encode the beam by use of the electro-optic effect. Applicant, conversely, claims (Claim 18), "a phase conjugator with a top electrode and that (See specification, page13, line 19), "the aperture may be substituted with a transparent top electrode." Thus, the secondary reference does not disclose Applicant's device because Applicant's electrode is used to produce a current in

the intra-cavity semi-conductor device to encode the phase conjugate beam and not to produce an electric field for encoding by the electro-optic effect as taught in Pepper.

Thus, the primary and secondary references disclose different technologies and provide no suggestion or incentive to combine elements in order to support an obviousness rejection. Accordingly, it is submitted that this rejection of claim 18 and dependent claims thereof under 35 U.S.C. §103(a) is without proper basis, is improper, and should be withdrawn.

As set forth above, **claim 13** and **40** stand rejected under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi in view of Pepper et al. and Pepper. Regarding claim 40, the Examiner indicates that Figures 1 and 2 in Akkappedi disclose the method of Applicant's claim 40 except for Applicant's element in claim 40 stating: "receiving said interrogating beam at an array of phase conjugators through apertures located in the top electrodes of the phase conjugators." The Examiner states that it would have been obvious to a person of ordinary skill in the art to use a phase conjugator as taught by Pepper in the method disclosed by Akkapeddi in view of Pepper et al. simply as a design choice of a phase conjugator. Applicant respectfully traverses the rejection.

In light of similar arguments for the 35 U.S.C. §103(a) rejections of claims 1 and 18 as stated above, it is submitted that this rejection of claim 40 under 35 U.S.C. §103(a) is additionally without proper basis, is improper, and should be withdrawn. In addition, claim 13 depends on claim 1. In light of arguments for claim 1 above, this rejection of claim 13 under 35 U.S.C. §103(a) is rendered moot.

As set forth above, **claim 22** is rejected under 35 U.S.C. §103(a) as being unpatentable over Akkapeddi or Sharp et al. The examiner references Figures 1 and 2 in Akkapeddi and Figures 2 and 5 in Sharp et al. The examiner indicates that the primary and secondary references disclose all of the limitations of rejected claim 22 except for Applicant's claim 22, element 3: "said communication station having a phase conjugator which is a VCSEL." Indeed, the Examiner states that it would have been obvious to a person skilled in the art to specifically use a VCSEL as the laser in the phase conjugator disclosed by either reference. Such a rejection is respectfully traversed.

Applicant submits that the Examiner is referring to the conventional use of VCSELS as a type of laser source, (e.g., for pumping a crystal phase conjugator). In arguments above, Akkappedi discloses a phase conjugator (i.e., a non-linear crystal) that is pumped by an **external** tunable diode laser (See Figure 2 and Column 2, lines 38-39). Sharp et al. (Figures 2 and 3, and Column 3, lines 5-68, Column 4, lines 1-13) disclose an **external** pump laser source as an input beam to establish a beam fan in a crystal. Applicant, conversely discloses (See specification, page 12, lines 14-27, page 13 lines 1-6), a "VCSEL" or Vertical Cavity Emitting Laser as a proposed embodiment of a broad area "intra-cavity" four-wave mixing medium for phase conjugation. Thus, the VCSEL in the Applicant's invention is not used to pump a medium for phase conjugation as is ordinarily used by those skilled in the art. In addition, there is no suggestion in the references that a VCSEL can be used as the phase conjugator as taught by Applicant.

Accordingly, this ground of rejection of claim 22 under 35 U.S.C. §103(a) is improper and should be withdrawn

As set forth above, **claim 23** is rejected under 35 U.S.C. §103(a) over Akkapeddi or Sharp et al., and further in view of Pepper et al. The rejection is respectfully traversed.

Claim 23 depends on claim 22. In light of the above arguments for claim 22, such an issue is believed moot and the rejection of claim 23 under 35 U.S.C. §103(a) is requested to be withdrawn.

Claims 25, 28, and **31-32** are rejected under 35 U.S.C. §103(a) as being unpatentable over Pepper et al. Applicant respectfully traverses the rejection.

In light of the arguments for the rejection of claim 24 under 35 U.S.C. §103(b) above and because claims 25, 28, and 31-32 are dependent claims thereof which contains the limitations of claim 24, the rejection under 35 U.S.C. §103(a) is rendered moot.

As set forth above, **claim 27** and **33** stand rejected under 35 U.S.C. §103(a) as being unpatentable over Pepper et al. in view of Pepper. The rejection is respectfully traversed.

In light of the arguments for the rejection of claim 24 under 35 U.S.C. §102(b) above and because claims 27, and 33 are dependent claims thereof which contains the limitations of claim 24, the rejection under 35 U.S.C. §103(a) is rendered moot.

Claims 35-39 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Sharp et al. in view of Pepper et al. This rejection is respectfully traversed.

Regarding **claim 35**, the Examiner indicated that although Sharp et al. does not specifically disclose pumping the encoded phase conjugate reflectivity by nondegenerate four wave mixing, it would have been obvious based on the teaching in Pepper et al. Regarding **claim 36**, the Examiner states that Sharp et al. does not specifically disclose an array of phase conjugators, however Pepper et al. teach a plurality of phase conjugators arranged in an array to produce a phase conjugate beam. Thus the Examiner indicates that it would have been obvious to arrange the interrogating beam and pump beams as suggested by Pepper et al. in the method disclosed by Sharp et al.

As stated above, Pepper et al. does not disclose nor suggest "intra-cavity" semiconductor four wave mixing. Pepper et al. (Figure 1, Column 5, lines 29-30), describes a phase conjugate apparatus that "includes a non-linear medium 12 capable of two wave mixing by SPS." SPS was defined in Pepper (Column 1, line 36) as "stimulated photorefractive scattering." Pepper et al. does teach a four-wave mixer (Column 10, lines 23-46, and Fig. 8) but the non-linear photorefractive medium is part of the embodiment. The Applicant, conversely, describes in his application (Figure 4, page 10, lines 5-7), "Figure 4 is an elevational view of the non-degenerative four wave mixing (NDFWM) in broad area (multimode) semiconductor laser diodes 334 (rather than passive photorefractive crystals)....." Thus, Pepper et. al. requires a non-linear medium (i.e., a crystal) as part of a phase conjugation system, which incorporates the photorefractive effect whereas Applicant utilizes a self-contained, "intra-cavity" phase conjugation system in a semiconductor package.

Accordingly, because the references fail to teach or suggest, either expressly or impliedly the Applicant's claimed phase conjugation device, the references fail to support a rejection of claims 35, 36 and dependent claims thereof under 35 U.S.C. §103(a) and is requested to be withdrawn.

Conclusion

Reconsideration and allowance of claims 1-44 and allowance of new claims 45-49 is respectfully requested. The Applicant respectfully submits that no new matter has been introduced by these amendments to the claims.

In the event that the Examiner finds any remaining impediment to the prompt allowance of these claims that can be clarified with a telephone conference, he is respectfully requested to initiate the same with the undersigned at (925) 422-3682.

Respectfully submitted,

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Attorney for Applicants
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Dated: 2/20/02

VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. (Amended) A system comprising:

a transceiver constructed to transmit an interrogating beam;

a communications station capable of receiving said interrogating beam; and

said communications station having a plurality of intra-cavity phase conjugators arranged in an array.

3. (Amended) The system of claim 1, wherein said communication station is configured to respond to said interrogating beam by encoding data into a phase conjugate beam in a [the]plurality of semiconductor laser diodes and pumping the encoded phase conjugate beam by intracavity nondegenerate four wave mixing.

10. (Amended) The system of claim 1, wherein the [apertures of the] plurality of intra-cavity phase conjugators each comprise an aperture [are] sufficient to resolve a substantial portion of the spatial components of the input wavefront of the interrogating beam.

11. (Amended) The system of claim 1, wherein the [apertures of the] plurality of intra-cavity phase conjugators each comprise an aperture [are] sufficient to resolve greater than approximately 80% of the spatial components of the input wavefront of the interrogating beam.

18. (Amended) A system comprising:

a transceiver constructed to transmit an interrogating beam; and

a communication station capable of receiving said interrogating beam; and

said communication station having an intra-cavity phase conjugator with a top electrode, wherein an electrode is located in said top electrode.

22. (Amended) A system comprising:

a transceiver constructed to transmit an interrogating beam;

a communication station capable of receiving said interrogating beam; and

said communication station having an intra-cavity phase conjugator which is a VCSEL structure.

24. (Amended) An optical interconnection system comprising:

a fiber optic device constructed to transmit an interrogating beam; and

a micro-mirror adapted to receive said interrogating beam and transmit the beam to a predetermined intra-cavity phase conjugator.

25. (Amended) The system of claim 24, wherein said intra-cavity phase conjugator is a VCSEL structure.

34. (Amended) A system comprising:

a means for transmitting and receiving an interrogating beam;

a communication station operatively coupled to said transmitting and receiving means and having a means for returning a phase conjugate beam to said transmitting and receiving means.

38. (Amended) The method of claim 36, wherein said interrogating beam interacts with at least one pump beam operating in each of said phase conjugators in a substantially parallel manner.

39. (Amended) The method of claim 36, wherein said interrogating beam interacts with at least one pump beam operating in each of said phase conjugators in a substantially transverse manner.

40. (Amended) A method comprising:

transmitting an interrogating beam from a transceiver;

receiving said interrogating beam at an array of intra-cavity phase conjugators through apertures located in the top electrodes of the phase conjugators;

modulating data onto a phase conjugate beam; and

transmitting the phase conjugate beam to said transceiver.

41. (Amended) A method comprising:

transmitting an interrogating beam from a transceiver;

receiving said interrogating beam at an array of intra-cavity phase conjugators and resolving a substantial portion of the spatial components of the input wavefront of the interrogating beam;

modulating data onto a phase conjugate beam; and

transmitting the phase conjugate beam to said transceiver.

42. (Amended) A method of providing an optical interconnect comprising:

transmitting an interrogating beam from a fiber optic device;

receiving said interrogating beam at a micro-mirror across free space;

transmitting a second beam from said micro-mirror to a predetermined phase conjugator.

45. (New) The system of claim 1, wherein said plurality of intra-cavity phase conjugators are arranged in a two dimensional array.

46. (New) The system of claim 1, wherein said plurality of intra-cavity phase conjugators includes:

a non-linear medium for each of said plurality of intra-cavity phase conjugators wherein said non-linear medium is adapted to produce at least two coherent pump beams; and

a means to encode said coherent pump beams.

47. (New) The system of claim 46, wherein said nonlinear medium is a diode structure comprising a broad-area distributed feedback laser device.

48. (New) The system of claim 18, wherein said intra-cavity phase conjugator with said top electrode includes:

a nonlinear medium adapted to produce at least two coherent pump beams; and

a means to encode said coherent pump beams.

49. (New) The system of claim 48, wherein said nonlinear medium is a diode structure comprising a modified broad-area distributed feedback laser device.